

WHAT IS CLAIMED IS:

1           1.     A circuit for controlling two switches bidirectional for the voltage and  
2     unidirectional for the current, assembled in anti-parallel, comprising, in series  
3     between two terminals of the anti-parallel assembly, two identical control stages  
4     respectively dedicated to each switch and between which is interposed a common  
5     impedance setting a phase angle for the turning-on of the switches, each stage  
6     comprising:

7                 a controllable current source for providing a current to a control electrode of  
8     the concerned switch;

9                 a capacitor for storing a supply voltage of at least the current source;

10                an element of activation/deactivation of the current source according to the  
11     voltage across the stage capacitor; and

12                an assembly for discharging the capacitor during the operation of the other  
13     stage.

1           2.     The circuit of claim 1, wherein said current source is sized to control  
2     the  $di/dt$  at the switching-on of the concerned switch.

1           3.     The circuit of claim 1, wherein said discharge assembly is activated as  
2     soon as the current in the concerned switch is canceled.

1           4.     The circuit of claim 1, wherein the capacitor of each stage is in series  
2     with a first diode, between the impedance and the stage terminal which is the same  
3     as the terminal of the anti-parallel assembly.

1           5.     The circuit of claim 4, wherein a second diode of each stage connects  
2     said impedance with said terminal of the stage which is the same as the anti-parallel  
3     assembly terminal.

1           6.     The circuit of claim 5, wherein a third diode connects the control  
2     electrode of the switch of each stage to the electrode of said capacitor, so that said  
3     discharge assembly also discharges the control electrode of the stage switch.

1           7.     The circuit of claim 1, wherein the respective capacitor of each stage  
2     provides the power supply necessary to all stage components.

1           8.     The circuit of claim 1, wherein said activation/deactivation element  
2     activates said current source with which it is associated when the voltage across the  
3     capacitor of the stage becomes greater than a first threshold, itself greater than the  
4     threshold voltage of the concerned switch.

1           9.     The circuit of claim 8, wherein said comparator deactivates said current  
2     source with which it is associated when the voltage across the capacitor of the stage  
3     becomes greater than a second threshold, itself preferably smaller than said  
4     threshold voltage of the concerned switch.

1           10.    The circuit of claim 1, wherein each discharge assembly comprises a  
2     first transistor in parallel with the stage capacitor, the control electrode of the first  
3     transistor being connected, via a second transistor, to said impedance.

1           11.    The circuit of claim 1, wherein said activation/deactivation element of  
2     each stage is formed of a comparator receiving at a first input the voltage across the  
3     stage capacitor and at a second input a reference voltage, said comparator being  
4     supplied by the voltage across the capacitor of the concerned stage.

1           12.    The circuit of claim 1, wherein said impedance is formed of a  
2     potentiometer.

1           13.    The circuit of claim 1, wherein said impedance is formed of a first  
2     resistor in parallel with a second switchable resistor, said first resistor having a much  
3     greater value than the second one.

1           14.    A power dimmer of a load, comprising the circuit of claim 1.

1           15.    A circuit for controlling a motor, comprising the circuit of claim 1.

1           16.    A power-reducing circuit, comprising:  
2     a load node;  
3     a supply node operable to receive a time-varying supply signal having a  
4     positive half period during which the load node is positive relative to the supply node  
5     and having a negative half period during which the load node is negative relative to  
6     the supply node;  
7     a first switch coupled to the load node and to the supply node;  
8     a second switch coupled to the load node and the supply node;

9 a first control stage coupled to the load node and operable to close the first  
10 switch during a portion of the positive half period of the supply signal; and  
11 a second control stage serially coupled between the first control stage and the  
12 supply node and operable to close the second switch during a portion of the  
13 negative half period of the supply signal.

1 17. The power-reducing circuit of claim 16 wherein the time-varying signal  
2 comprises a sinusoidal voltage signal.

1 18. The power-reducing circuit of claim 16 wherein:  
2 the first control stage is operable to open the first switch when a current  
3 through the first switch decays to approximately zero; and  
4 the second control stage is operable to open the second switch when a  
5 current through the second switch decays to approximately zero.

1 19. The power-reducing circuit of claim 16 wherein the first control stage  
2 comprises:  
3 a capacitor operable to receive a charging current during the positive half  
4 period of the supply signal;  
5 a comparator operable to close the first switch when a voltage across the  
6 capacitor exceeds a first reference voltage and to open the first switch when the  
7 voltage across the capacitor is less than a second reference voltage; and  
8 a discharge circuit operable to discharge the capacitor when the charging  
9 current decays to approximately zero.

1 20. The power-reducing circuit of claim 16 wherein the second control  
2 stage comprises:  
3 a capacitor operable to receive a charging current during the negative half  
4 period of the supply signal;  
5 a comparator operable to close the second switch when a voltage across the  
6 capacitor exceeds a first reference voltage and to open the second switch when the  
7 voltage across the capacitor is less than a second reference voltage; and  
8 a discharge circuit operable to discharge the capacitor when the charging  
9 current decays to approximately zero.

1           21.    The power-reducing circuit of claim 16, further comprising an  
2 adjustable impedance serially coupled between the first and second control stages.

1           22.    A system, comprising:

2           first and second supply nodes operable to receive a time-varying supply  
3 signal having a positive half period during which the first supply node is positive  
4 relative to the second supply node and having a negative half period during which  
5 the first supply node is negative relative to the second supply node;

6           a load having a first node coupled to the first supply node and having a  
7 second node; and

8           a power-reducing circuit coupled between the second node of the load and  
9 the second supply node and comprising,

10                   a first switch coupled between the load and the second supply  
11 node,

12                   a second switch coupled between the load and the second  
13 supply node,

14                   a first control stage coupled to the load and operable to close the  
15 first switch during a portion of the positive half period of the supply signal; and

16                   a second control stage serially coupled between the first control  
17 stage and the second supply node and operable to close the second switch  
18 during a portion of the negative half period of the supply signal.

1           23.    The system of claim 22 wherein the load comprises an inductive load.

1           24.    A method, comprising:

2           driving a load with a time-varying signal;

3           charging a first capacitor with a first current that flows through the load during  
4 a first portion of the signal;

5           causing a second current to flow through the load when a voltage across the  
6 first capacitor exceeds a first predetermined voltage; and

7           prohibiting the second current from flowing through the load when the voltage  
8 across the first capacitor decays to approximately a second predetermined voltage.

1           25.    The method of claim 24, further comprising adjusting a time that the  
2 second current flows through the load by adjusting the first current.

1           26.    The method of claim 24 wherein a total current through the load equals  
2 a sum of the first and second currents.

1           27.    The method of claim 24 wherein the second current is significantly  
2 greater than the first current.

1           28.    The method of claim 24 wherein:  
2           causing the second current to flow comprises closing a switch in series with  
3 the load; and  
4           prohibiting the second current from flowing comprises opening the switch.

1           29.    The method of claim 24 wherein:  
2           causing the second current to flow comprises activating a transistor in series  
3 with the load;  
4           prohibiting the second current from flowing comprises deactivating the  
5 transistor; and  
6           the second predetermined voltage comprises a threshold of the transistor.

1           30.    The method of claim 24, further comprising:  
2           charging a second capacitor with a third current that flows through the load  
3 during a second portion of the signal;  
4           causing a fourth current to flow through the load when a voltage across the  
5 second capacitor exceeds a third predetermined voltage; and  
6           prohibiting the fourth current from flowing through the load when the voltage  
7 across the second capacitor decays to approximately a fourth predetermined  
8 voltage.

1           31.    A method, comprising:  
2           driving a load with a time-varying signal;  
3           charging a capacitor with a first current that flows through a load during a first  
4 portion of the signal;  
5           causing a second current to flow through the load when a voltage across the  
6 capacitor exceeds a predetermined voltage; and  
7           prohibiting the second current from flowing through the load when the first  
8 current decays to approximately a predetermined current.

- 1           32.    The method of claim 31 wherein the predetermined current equals zero
- 2   current.